Newcastle University e-prints

Vulnerability factors for bipolar disorders as predictors of attributions in ability-based and chance-based tests

Thomas D. Meyer [1 2], Stephen Barton [1], Marina Baur [2], & Gabriele Jordan [1]

[1] Newcastle University, UK

[2] University of Tübingen, Germany

Accepted for publication in:

Journal of Individual Differences

[uncorrected version]

Correspondence regarding this manuscript should be sent to:

Thomas D. Meyer, Ph.D., Newcastle University, Institute of Neuroscience, Doctorate in Clinical Psychology, Ridley Building (4th floor), Newcastle Upon Tyne, NE1 7RU, England: E-mail: thomas.meyer@newcastle.ac.uk

Abstract

Recently the role of attributional style for bipolar disorder has received more interest and empirical support. A pattern of global, stable and possibly internal attributions after positive events might even trigger mania. We here tested whether hypothesized risk factors for bipolar disorder are associated with such attributions after feedback of success in an achievement- and chance-based test. University students (n = 115) completed the Behavior Inhibition and Behavior Activation Scales (BIS/BAS) and Hypomanic Personality Scale (HPS) to assess risk for bipolar disorder. In addition they were interviewed using the Structured Clinical Interview. All participants performed an ability-based test and a chance-based test and success was induced by providing positive feedback regardless of their actual test performance. Attributions of their perceived success were assessed after each test respectively. We found that high scores on the BAS scale were generally predictive of self-serving attributions in the ability-based test, whilst scores on the HPS predicted a more global and self-serving attributional style in the chance-based test. Current depression, lifetime affective disorder, BIS or the dysregulation of the BAS did not consistently predict attributions on either test. Despite some methodological limitations, the results suggest that anticipated or experienced success in skill-related contexts triggers self-serving attributions in individuals scoring high on the BAS scale, whilst perceived positive outcome in chance-related, more unrealistic contexts triggers similar attributions in individuals scoring high on the HPS. Future research has to examine whether these overly positive attributions after positive, chance-related situations are a stable characteristic with respect to vulnerability to mania.

KEYWORDS: Bipolar disorder, vulnerability, hypomanic personality, behaviour activation, attribution

Introduction

A self-defeating pattern of attributions to behavioral outcomes is commonly reported in depressed individuals who feel personally responsible for negative events or failure on a task and who also assume that such negative events or failure are due to uncontrollable factors. Classically, this pessimistic, cognitive bias is characterized by attributions to internal, stable and global factors after negative outcome (e.g. Alloy et al., 2000, 2006; Abramson, Metalsky, & Alloy, 1989; Klein, Fencilmorse, & Seligman, 1976).

An association between bipolar disorder, especially mania, and a specific attributional style has only recently been considered (e.g. Alloy et al., 2005; Reilly-Harrington, Alloy, Fresco, & Whitehouse, 1999). It is widely accepted now that cognitive and affective responses in relation to goal attainment and achievement can trigger manic symptoms in people suffering from bipolar disorders (BD) and similar processes can be observed in those at risk for BD (for review: Johnson, 2005). For example, individuals at risk for BD are unrealistically optimistic about reaching their goals (Meyer & Krumm-Merabet, 2003) and express global attributions for hypothetical positive (and negative) events, e.g. they generalize from succeeding in one exam to succeeding in other exams (Thompson & Bentall, 1990). Most studies which looked at attributions or cognitive style related to affective disorders focused on trait-like attributional styles and did not look at actual attributions elicited in actual situations, e.g. after passing an exam or winning the lottery. In the case of chance-based situations (e.g. winning the lottery), people should attribute success to external, unstable and specific causes, but if an overly positive attributional bias is a core vulnerability factor for BD, then it should also be observed in test situations in which the outcome is dependent on chance alone. Stern and Berrenberg (1979) looked at situation-specific attributions and found indeed that individuals with a high score on a mania scale attributed their success in both an ability-based and a chance-based test to more internal, stable and global factors compared to control participants.

Recently, Johnson, Ruggero and Carver (2005) used the Hypomanic Personality Scale (Eckblad & Chapman, 1986) to assess risk for BD and reported that individuals with high scores set higher goals after feedback of success, which could be interpreted as a logical consequence of the attributional bias found by Stern and Berrenberg (1979). Such results support a cognitive-attributional model postulating a potential link between causal attributions of successful outcomes and risk for BD, especially mania, in that 'self-serving' cognitive processes (e.g. highly positive internal, stable and global attributions; and high goal setting) are activated by anticipated or imagined success. This could explain how an upward spiral from positive affect into (hypo-) mania can be triggered in vulnerable individuals.

However, the link between success-related cognitive processes, affect and mania can also be made in reference to the model of Behavioral Activation, which, according to the classic theory of reinforcement sensitivity (for review: Corr, 2008), is thought to control appetitive motivation, reactions to signals of reinforcement and expectations of reward and is linked to positive affect. Thus, it has been suggested that a dysregulation of the Behavioral Activation System (BAS) is the core component of bipolar disorder and that extreme levels in BAS activity can account for the symptoms of an affective episode. High levels of activation lead to higher reward motivation, increased sensitivity to rewarding stimuli and also stronger seeking of pleasure and excitement (Depue & Iacono, 1989; Depue & Zald, 1993). The resulting positive affect can develop into euphoria, a core symptom of mania. On the other hand, low levels of BAS activation (e.g. lack of motivation for incentivising rewards, anhedonia) are characterized by low (or lack of) positive affect and depression (Joiner, Brown, & Metalsky, 2003; Watson, Clark, & Carey, 1988). In this model, (hypo-)manic and depressive episodes can be seen as opposite manifestations of BAS activity, whereas the Behavioral Inhibition System (BIS) is considered less important here (Depue & Zald, 1993). Both models – the cognitive-attributional and the Behavioural Activation model – predict that a real or anticipated positive behavioral outcome can trigger mania in vulnerable individuals.

However, the models differ in their respective definitions of core vulnerability and it is critically important to look at how vulnerability is operationalized. The two most frequently used instruments are the Hypomanic Personality Scale (HPS, Eckblad & Chapman, 1986) and the Behavioral Activation Scales (BIS-BAS, Carver & White, 1994).

The BIS-BAS self-report scales were initially developed to measure individual differences in sensitivity of behavioral activation and they are now well established and validated. More importantly, the BAS scale has been found to directly relate to vulnerability for mania in non-clinical samples and to predict changes in symptoms in individuals diagnosed with a bipolar spectrum disorder (e.g. Alloy et al., 2008; Meyer, Johnson, & Carver, 1999; Meyer, Johnson, & Winters, 2001). However, a recent study did not find evidence of an association of increased scores on the BAS scale and symptoms in young bipolar patients (Biuckians, Miklowitz, & Kim, 2007) and, in fact, no study to date has investigated the predictive validity of the scale for first onset of BD. If the dysregulation of behavioral activation is a trait-like factor in BD, as postulated by Depue and Zald (1993), and if the BAS scale is a valid measure for this trait, then individuals who exhibit increased scores should show overly optimistic attributions with respect to positive situations.

The Hypomanic Personality Scale is also frequently used to assess vulnerability for BD in the general population (Eckblad & Chapman, 1986) and, although it is less specifically linked to any theoretical model, several studies provide empirical evidence for its concurrent and predictive validity (e.g. Blechert & Meyer, 2005; Johnson, Ballister, & Joiner, 2005; Kwapil et al., 2000; Meyer, 2002).

One study, that directly compared the outcomes of HPS and BAS, found that both scales were associated with approach goals, but the relationship between HPS and approach goals disappeared when outcome on the BAS scale was controlled for (Jones, Sham, & Liversidge, 2007). Meyer and Hofmann (2005) also compared the two instruments and found that both

scales predicted the level of positive affect and manic symptoms over a one-month period in a non-clinical sample, but fluctuations of mood were more closely associated with HPS.

We here used both the BAS scale and the HPS to assess vulnerability for BD in a non-clinical population. To investigate attributions, we followed an experimental approach in which the participants' performance was manipulated to induce success. To test whether a cognitive bias in causal attributions of success exists in those individuals who score high on the vulnerability measures, we introduced two tests: an 'intelligence test' which is necessarily linked to the participants' own abilities and a 'dice test' in which outcome should be related to chance alone. We predict that the higher the risk for BD, the more the cognitive bias will resemble that of patients with BD, i.e. they should more strongly attribute success to internal, stable and global causes in both tests compared to those at lower risk. Our second aim was to investigate how much of the variance can be explained by the two scales (BAS and HPS) as this will have implications for our theoretical understanding of core vulnerability to BD. In addition to prior studies (e.g. Johnson et al., 2005b), we also controlled for the presence of psychiatric disorders by clinical interviews.

Method

Participants

One hundred and twenty nine males, primarily non-psychology students, were recruited in Tübingen (Germany) and tested individually. They all completed the HPS and the BIS/BAS Scales (see below). Fourteen participants were excluded due to missing data, so that the final sample consisted of n = 115. The mean age was 23.99 years (SD = 2.74, range 18-29).

Materials

Hypomanic Personality Scale (HPS, Eckblad & Chapman, 1986). The HPS is a self-rating scale consisting of 48 items with good psychometric properties (e.g. Eckblad & Chapman, 1986; Meyer & Hofmann, 2005) which has been widely used and proved to be predictive of

bipolarity (e.g. Blechert & Meyer, 2005; Jones et al., 2007; Kwapil et al., 2000; Meyer & Maier, 2006).

BIS/BAS-Scales (Carver & White, 1994). The Behavioral Activation Scale consists of three subscales: Reward responsiveness, drive, and fun-seeking, but some authors conceptualize BAS as one single dimension (e.g. Caseras, Avila, & Torrubia, 2003; Meyer & Hofmann, 2005; Ross et al., 2002). The Behavioral Inhibition Scale (BIS, 7 items) measures the tendency to respond with negative affect or anxiety to threatening events. The psychometric properties of the scales are moderate to good (e.g. Carver & White, 1994; Meyer et al., 2001). Holzwarth and Meyer (2006) extended the scale to capture the dysregulation of the BAS (BAS-Dys).

Structural Clinical Interview for DSM-IV (SCID-I, [German]: Wittchen, Zaudig & Fydrich, 1997). The 'lifetime' format of the SCID-I Interview was used to assess both current and former DSM-IV axis-I disorders (American Psychiatric Association, 1994). We here focused on affective and psychotic disorders. Two interviewers were trained to ensure reliable assessment and any uncertainties were resolved by consensus decisions with an expert. Twelve participants fulfilled DSM-IV criteria for affective disorders (n = 9 Major Depression, n = 5 BD).

Center for Epidemiological Studies-Depression Scale (CES-D, Radloff, 1977). The CES-D consists of 20 items assessing current depressive symptoms covering the last week prior to testing (Meyer & Hautzinger, 2001, 2003). We have used the validated shorter version with 15 items suitable for German samples (Hautzinger & Bailer, 1993).

Advanced Progressive Matrices (APM, Raven, Court, & Raven, 1980). The so-called RAVEN test was chosen to induce success in an 'ability'-based test. Only a subset of items was used as the purpose was not to have a reliable indicator for intelligence. To familiarize participants with the test, we chose six items of the first set of tasks with solving probabilities ranging from .88 to .93. These were followed by 10 items with higher levels of difficulty (i.e.

.45 < p < .84). Finally, six further items were added with solving probabilities of .04 < p < .44. To increase stress levels and to prevent guessing of one's performance, we set an overall time restraint of 15 minutes.

Dice test. The test was chosen to induce success in a chance-based setting and consisted of 10 trials with three dices. The objective was to get as many points as possible. The participants were not told that the dices were manipulated, i.e. '6' was the most likely outcome.

Current attribution questionnaire (CAQ). To assess current attributions of performance, we adapted the Attributional and Cognitive Style Questionnaires (CSQ) (e.g. Alloy et al., 2000; Peterson et al., 1982) which assess individual differences in attributions: internal attribution, stable attribution, global attribution, and personal relevance attribution. The wording was changed such that the questions directly referred to the two specific test scenarios (i.e. Raven's test, dice test): For example the item for 'internal attribution' was: 'Think about the cause of you having high scores in the intelligence test. Is it something about you, or something about other people or circumstances that causes you to have such high scores?'. The answer format ranged from 1 to 7 with '1' indicating low and '7' indicating high stability, globality and internality, or personal relevance, respectively.

Procedure

The participants signed an informed consent form, but were only debriefed in full after testing was complete. First, all participants filled in the trait measures and the CES-D. Then the ability-based Raven test was introduced. After completion, a second interviewer collected the test and the participants were made to believe that the test was to be scored by that person. Irrespective of their actual performances, all participants received positive feedback of having 'correctly solved 90% of the test, therefore belonging to the top 10%' of all participants and they were then asked to complete the modified CAQ. This was followed by introducing the chance-based dice test and separate measure on the CAQ specific to this test. Based on Stern

and Berrenberg's (1979) results, it seemed important to differentiate between attributions of test performance on chance-related and skill-related tests, because a self-serving attributional bias was primarily expected for the chance-related test. Finally, participants were interviewed using the SCID I (see also Meyer & Baur, 2009).

Statistical analyses

Hierarchical regression analyses were conducted with different types of attribution as outcome variables. As a first block of predictors we included potential confounds, i.e. current symptoms of depression (scores on CES-D) and a lifetime history of an affective disorder. Block two contained the scores on the BIS-BAS scales. Rather than looking at the BAS subscales we used the composite BAS score, because reliability of the subscales are often low (e.g. Caseras et al., 2003; Meyer & Hofmann, 2005) and the Behavioural Activation model of Depue and Iacono (1989) does not postulate that different facets of BAS are differently associated with risk for affective disorders [1]. Block three used the scores on HPS as predictor variable. The rational for entering the HPS last was that we were especially interested in whether scores on the HPS can still explain some of the variance after outcome on the BAS scale has been accounted for.

Results

The unstandardized and standardized betas of the regression models predicting attributions after success in two unrelated tests are presented in Table 1.

Internal attributions: Model 1, including current symptoms of depression and diagnosis of affective disorder as predictors of internal attributions after success in the ability test, was not significant (Model 1: $F_{(2,114)} = 0.03$, $R = .023$, $R^2 = .001$). When adding scores on BIS, BAS and BAS-Dysregulation as predictors for internal attributions in Model 2, the model approached significance (Model 2: $F_{(5,114)} = 2.08$, $p < .10$, $R = .295$, $R^2 = .087$). Only when adding the HPS scores, the overall model became significant (Model 3: $F_{(6,114)} = 2.25$, $p < 0$

.05, R =.351, R^2 =.123). The change in R^2 for this model was significant implying that adding HPS improved prediction (ΔR^2 =.036, $F_{(1,101)} = 4.43$, $p < .05$). The only two significant predictors, however, were scores on BAS and HPS. While higher BAS scores were predicting stronger internal attributions, the opposite was the case for HPS.

When looking at the chance-based task, none of the models proved to be significant (Model 1: $F_{(2,114)} = 0.21$, R =.062, R^2 =.002; Model 2: $F_{(5,114)} = 0.19$, R =.092, R^2 =.008, ΔR^2 =.005; Model 3: $F_{(6,114)} = 0.77$, R =.203, R^2 =.041, ΔR^2 =.033). [2]

Stable attributions: When only current or lifetime affective symptoms were considered as predictors for stable attributions after success in the ability-based test, the model was not significant (Model 1: $F_{(2,114)} = 0.56$, R =.10, R^2 =.01). When the BIS-BAS dimensions were included as predictors a trend emerged (Model 2: $F_{(5,114)} = 2.20$, $p < .10$, R =.303, R^2 =.092, ΔR^2 =.082), but after adding HPS scores, the overall model became significant (Model 3: $F_{(6,114)} = 2.39$, $p < .05$, R =.342, R^2 =.117, ΔR^2 =.026). The change in R^2 for this model was approaching significance (ΔR^2 $F_{(1,101)} = 3.15$, $p < .10$), but only BAS scores predicted stable attributions.

Looking at stable attributions after success in the chance-based test, Model 1 did not prove to be significant (Model 1: $F_{(2,114)} = 0.11$, R =.045, R^2 =.002) and neither did Model 3 (Model 3: $F_{(6,114)} = 1.91$, $p < .10$, R =.31, R^2 =.096, ΔR^2 =.001). Model 2 produced a trend (Model 2: $F_{(5,114)} = 2.28$, p =.052, R = .307, R^2 = .095, ΔR^2 = .093). The change in R^2 for this model was, however, significant (ΔR^2 $F_{(3,109)} = 3.71$, $p < .05$) with BIS scores predicting significantly more stable attributions. [3]

Global attributions: Although all three models predicting global attributions after success in the ability-based test reached significance (Model 1: $F_{(2,114)} = 5.81$, $p < .01$, R =.306, R^2 =.094; Model 2: $F_{(5,114)} = 3.28$, $p < .05$, R =.361, R^2 =.131, ΔR^2 =.037; Model 3: $F_{(6,114)} = 2.76$, $p < .05$, R =.364, R^2 =.133, ΔR^2 =.002), adding predictors to current or lifetime affective symptoms did not significantly contribute to explain any of the variance (Model 2: ΔR^2

$F_{(3,109)} = 1.54$; Model 3: ΔR^2 $F_{(1,101)} = 0.30$). The only significant predictor within Model 1 was current symptoms of depression.

In the chance-based test, neither Model 1 (Model 1: $F_{(2,114)} = 1.54$, $R = .163$, $R^2 = .027$) nor Model 2 (Model2: $F_{(5,114)} = 1.40$, $R = .246$, $R^2 = .060$, $\Delta R^2 = .034$) significantly predicted global attributions as success, but when HPS scores were added, Model 3 was significant (Model 3: $F_{(6,114)} = 2.45$, $p < .05$, $R = .347$, $R^2 = .12$, $\Delta R^2 = .06$). The increase in R^2 was significant (ΔR^2 $F_{(1,101)} = 7.53$, $p < .01$). Current symptoms of depression as well as HPS scores were significant predictors, but with opposite effects: The former being associated with less and the latter being associated with more global attributions. [4]

Personal relevance attributions: Model 1 was not significant in predicting attributions to personal relevance after success in the ability test (Model 1: $F_{(2,114)} = 1.21$, $R = .145$, $R^2 = .021$), but adding the BIS-BAS dimensions yielded a significant model (Model 2: $F_{(5,114)} = 3.52$, $p < .01$, $R = .373$, $R^2 = .139$, $\Delta R^2 = .118$). The change in R^2 was significant (ΔR^2 $F_{(3,109)} = 4.97$, $p < .01$). After adding HPS scores, Model 3 was also significant (Model3: $F_{(6,114)} = 2.90$, $p < .05$, $R = .373$, $R^2 = .139$, $\Delta R^2 = .000$), but adding HPS scores did not significantly increase R^2 (ΔR^2 $F_{(1,108)} = 0.01$). According to Model 2, only BAS emerged as a significant predictor with higher scores being related to more relevance assigned to success in the ability-based test result.

Looking at the attributions to personal relevance after success in the chance-related test, no model was significant (Model 1: $F_{(2,114)} = 0.04$, $R = .026$, $R^2 = .001$; Model 2: $F_{(5,114)} = 1.69$, $R = .268$, $R^2 = .072$, $\Delta R^2 = .071$; Model 3: $F_{(6,114)} = 1.79$, $R = .301$, $R^2 = .092$, $\Delta R^2 = .019$). [5]

Cognitive style: In line with other research (e.g. Alloy et al., 1999, 2006) we also calculated a composite score for attributions reflecting a self-serving attributional style towards high internal, stable, global and personally relevant attributions (Table 2). The attributional patterns after success in the ability- and chance-based tests did not significantly correlate with each other ($r = .03$).

Current depressive symptoms and lifetime affective disorder did not predict self-serving attributions in the ability test (Model 1: $F_{(2,114)} = 0.56$, R =.179, R^2 =.032), but after adding BIS-BAS dimensions, the model was significant (Model 2: $F_{(5,114)} = 4.80$, $p < .001$, R =.425, R^2 =.180, ΔR^2 =.148). Adding HPS scores also resulted in a significant model (Model 3: $F_{(6,114)} = 4.53$, $p < .001$, R =.448, R^2 =.201, ΔR^2 =.021), but it only showed a trend for change in R^2 (ΔR^2 $F_{(1,108)} = 2.80$, $p < .10$), while change in R^2 for Model 2 was significant (ΔR^2 $F_{(3,109)} = 6.58$, $p < .001$). BAS emerged as the only significant predictor, with higher BAS scores predicting a stronger self-serving attributional style.

In the chance-based test, neither affective symptoms (Model 1: $F_{(2,114)} = 1.21$, R =.100, R^2 =. 01), nor adding the BIS-BAS dimensions (Model 2: $F_{(5,114)} = 1.42$, R =.248, R^2 =.061, ΔR^2 =.051) resulted in a significant model. Including HPS scores led, however, to a significant model (Model 3: $F_{(6,114)} = 2.24$, $p < .05$, R =.333, R^2 =.111, ΔR^2 =.049) and the change in R^2 change was significant (ΔR^2 $F_{(1,108)} = 6.00$, $p < .05$). Significant predictors for cognitive style were current symptoms of depression and scores on HPS with opposite effects - depression predicting a rather self-handicapping and HPS predicting a stronger self-serving attributional style. [6]

Discussion

Based on research linking cognitive factors, such as attributions to positive and negative events, with bipolar disorder (e.g. Alloy et al., 2005; Johnson, 2005), we examined whether two hypothesized risk factors – behavioural activation (and its dysregulation) as well as hypomanic personality – are predictive of specific patterns of attributions after inducing the experience of success.

In the intelligence test, performance on both BAS scale and HPS were predictive of specific attributions, intriguingly however, their predictive powers were in opposite directions. Specifically, behavioural activation – but not its dysregulation - was more

predictive of a self-serving cognitive style after success in the ability-based test, reflected by attributions to internal and stable causes with high personal relevance to the participants. On the other hand, hypomanic temperament was more predictive of external attributions after success.

A different picture emerged when looking at the attributions to success in the chance-based test, i.e. playing with dices: While BAS scores were not of relevance, high scores on HPS were predictive of stronger global attributions as well as a stronger overall self-serving attributional style. Neither a lifetime diagnosis of an affective disorder nor the current level of depressive symptoms did explain much of the variance, but current depressive symptoms were predicting more specific attributions after success. The BIS dimension only showed marginal associations with attributions made after success.

It may seem at first that our results for behavioral activation and hypomanic personality are contradictive, but two points can potentially resolve this contradiction: First of all, the BAS scale and HPS are different in their item content. While the former focuses on reward responsiveness, drive, and fun-seeking (Carver & White, 1994), the HPS assesses a premorbid affective temperament including subsyndromal manifestations of bipolarity such as mood swings or changes in activity levels (Eckblad & Chapman, 1986). We assume that HPS and BAS represent different risk factors for BD. BAS has been linked to mania and depression in people at risk for BD, but not controls (Meyer et al, 1999) and it has also been shown to predict increases in manic symptoms in bipolar patients (Alloy et al., 2008; Meyer et al., 2001). Johnson et al. (2000, 2008) showed that goal attainment predicted mania over time in patients with BD. Personal involvement in reaching goals or having success seem essential, because general positive experiences do predict changes in mania. Our results imply that inter-individual differences in BAS are associated with specific attributions made after the outcome of a task that presumably requires certain skills or abilities, but not when the performance is chance-related, such as playing with dice. It could be that success in skill-

related tests increases positive affect in non-vulnerable individuals, but sets off processes that may spiral into mania in individuals suffering from BD. No study has yet investigated, whether BAS is a prospective risk factor for the onset of BD, but it may well be a risk factor for the recurrence of mania in people who are already suffering from BD (Johnson, 2005).

Looking at hypomanic temperament, we found evidence that it is associated with external attributions after receiving positive feedback in the ability-based test. However, when these individuals are performing a test based on chance outcome, more global and overall more self-serving attributions were made after feedback of success, which is in line with other research indicating that individuals vulnerable for BD set even higher goals after success (e.g. Meyer & Krumm-Merabet, 2003; Thompson & Bentall, 1990).

What could the results concerning the HPS imply? In contrast to the BAS scale, there is evidence that HPS predicts future BD (e.g. Blechert & Meyer, 2005; Kwapil et al., 2000), so the self-serving attributional style after chance-related success found in our study might already indicate an engagement with goals that are highly unrealistic. Individuals may put more effort, energy and time into activities for which the outcomes and consequences are less predictable and uncertain. This, in turn, may lead into a manic spiral.

A number of limitations of our study should be considered. First, we relied on a university student population for convenience. However, having a reasonably homogeneous sample of educated people should have worked against finding differential associations, especially when it comes to admitting internal, global and stable attributions of their performance in the dice test. We would predict the effects to be even more pronounced in a more diversified sample. Second, one might question the use of a single item in the CAQ to assess each dimension of attribution due to reliability issues. Although we cannot resolve this issue, the results for the overall self-serving attributional style seem to suggest that this has probably not affected our results. Additionally, and in contrast to others (e.g. Alloy et al., 1999; Thompson & Bentall, 1990), we were not interested in trait-like attributional styles per se, but rather what kind of

attributions are elicited in specific situations. However, it would be important to investigate whether these situation-specific attributions are stable across time and tasks. Third, unfortunately we cannot rule out the possibility of carry-over effects, because the two tests were not presented in random order. Future research should take into account such possible effects of order and also include conditions of no-feedback, neutral or negative feedback.

Despite these limitations we conclude that our results add to the growing evidence that real or anticipated success in some tasks might play a role in setting off a spiral of cognitive and emotional reactions in people who are vulnerable for mania or BD that may eventually turn into (hypo-)mania (e.g. Johnson et al., 2000, 2005b). More importantly we have shown that, after controlling for a lifetime history of affective disorders and current level of depressive symptoms, different types of risk factor for bipolar disorder seem to be related to different cognitive styles depending on the circumstances: Our results imply that behavioral activation is more closely related to cognitive processes in ability-related tests, whereas hypomanic temperament predicts self-serving cognitions to unattainable or unrealistic goals such as influencing chance.

References

Abramson, L.Y., Metalsky, G.L., & Alloy L.B. (1989). Hopelessness depression. A theory-based subtype of depression. *Psychological Review, 96*, 358-372.

Alloy, L.B., Abramson, L.Y., Hogan, M.E., Whitehouse, W.G., Rose, D.T., Robinson, M.S., Kim, R.S., & Lapkin, J.B. (2000). The Temple-Wisconsin cognitive vulnerability to depression project: Lifetime history of axis I psychopathology in individuals at high and low cognitive risk for depression. *Journal of Abnormal Psychology*, 109, 403-418.

Alloy, L.B., Abramson, L.Y., Urosevic, S., Walshaw, P.D., Nusslock, R., & Neeren, A.M. (2005). The psychosocial context of bipolar disorder: environmental, cognitive, and developmental risk factors. *Clinical Psychology Review, 25*, 1043-1075.

Alloy, L.B., Abramson, L.Y., Walshaw, P.D., Cogswell, A., Grandin, L.D., Hughes, M.E., Iacoviello, B.M., Whitehouse, S., Urosevic, S., Nusslock, R., & Hogan, M.E. (2008). Behavioral Approach System and Behavioral Inhibition System sensitivities and bipolar spectrum disorders: prospective prediction of bipolar mood disorders. *Bipolar Disorders, 10, 310-322*.

Alloy, L.B., Abramson, L.Y., Whitehouse, W.G., Hogan, M.E., Panzarella, C., & Rose, D.T. (2006). Prospective incidence of first onsets and recurrences of depression in individuals at high and low cognitive risk for depression. *Journal of Abnormal Psychology*, 115**,** 145–156.

Alloy, L. B., Reilly-Harrington, N., Fresco, D. M., Whitehouse, W. G., & Zechmeister, J. S. (1999). Cognitive styles and life events in subsyndromal unipolar and bipolar disorders: Stability and prospective prediction of depressive and hypomanic mood swings. *Journal of Cognitive Psychotherapy: An International Quarterly, 13*, 21-40.

American Psychiatric Association (1994). *Diagnostic and Statistical Manual of Mental Disorders. 4th Edition*. American Psychiatric Association: Washington D.C.

Biuckians, A., Miklowitz, D.J., & Kim, E.Y. (2007). Behavioral activation, inhibition, and mood symptoms in early-onset bipolar disorder. *Journal of Affective Disorders, 97*, 71-76.

Blechert, J., & Meyer, T.D. (2005). Are the scales Hypomanic Personality, Impulsive Nonconformity and Rigidity predictors of bipolar symptoms? *British Journal of Clinical Psychology*, *44*, 15-27.

Carver, S., & White, T.L. (1994). Behavioural Inhibition, Behavioural Activation and Affective Responses to Impending Reward and Punishment: The BIS/BAS-Scales. *Journal of Personality and Social Psychology, 67*, 319-333.

Caseras, X., Àvila, C., & Torrubia, R. (2003). The measurement of individual differences in Behavioural Inhibition and Behavioural Activation Systems: a comparison of personality scales. *Personality and Individual Differences, 34*, 999-1013.

Corr, P.J. (2008). *The Reinforcement Sensitivity Theory of Personality*. Cambridge: Cambridge University Press.

Depue, R.A., & Iacono, W.G. (1989). Neurobehavioral Aspects of Affective Disorders. *Annual Review of Psychology*, 40, 457-492.

Depue, R.A., & Zald, D.H. (1993). Biological and environmental processes in nonpsychotic psychopathology: A neurobehavioral perspective. In: C.G. Costello (Ed.), *Basic issue in psychopathology, 27-237*. New York: Guilford Press.

Eckblad, M., & Chapman, L.J. (1986). Development and validation of a scale for hypomanic personality. *Journal of Abnormal Psychology*, 95, 214-222.

Hautzinger, M., & Bailer, M. (1993). *Allgemeine Depressions Skala*. *Manual.* Weinheim: Beltz Test GmbH.

Holzwarth, K., & Meyer, T.D. (2006). The dysregulation of the Behavior Activation System. *Personality and Individual Differences, 41*, 319-328.

Johnson, S.L. (2005). Mania and dysregulation in goal pursuit: A review. *Clinical Psychology Review*, 25, 241-262.

Johnson, S.L., Cuellar, A.K., Ruggero, C., Winett-Perlman, C., Goodnick, P., White, R., & Miller, I. (2008). Life events as predictors of mania and depression in bipolar I disorder. *Journal of Abnormal Psychology*, *117*, 268-277.

Johnson, S.L., Ballister, C., & Joiner, Jr. T.E. (2005a). Hypomanic vulnerability, terror management, and materialism. *Personality and Individual Differences, 38,* 287-296.

Johnson, S.L., Ruggero, C.J., & Carver, C.S. (2005b). Cognitive, behavioural, and affective responses to reward: links with hypomanic symptoms. *Journal of Social and Clinical Psychology, 24*, 894-906.

Johnson, S.L., Sandrow, D., Meyer, B., Winters, R., Miller, I., Solomon, D., & Keitner, G. (2000). Increases in manic symptoms after life events involving goal attainment. *Journal of Abnormal Psychology*, *109*,721-727.

Joiner, T.E., Brown, J.S., & Metalsky, G.I. (2003). A test of the tripartite model's prediction of anhedonia's specificity to depression: patients with major depression versus patients with schizophrenia. *Psychiatry Research, 119*, 243-250.

Jones, S., Shams, M., & Liversidge, T. (2007). Approach goals, behavioural activation and risk for hypomania. *Personality and Individual Differences, 43*, 1366-1375.

Klein, D.C., Fencilmorse, E., & Seligman, M.E.P. (1976). Learned helplessness, depression, and attribution of failure. *Journal of Personality and Social Psychology*, *33*, 508-516.

Kwapil, T.R., Miller, M.B., Zinser, M.C., Chapman, L.J., Chapman, J., & Eckblad, M. (2000). A longitudinal Study of High Scorers on the Hypomanic Personality Scale. *Journal of Abnormal Psychology, 109*, 222-226.

Meyer, B., Johnson, S.L., & Carver, C.S. (1999). Exploring behavioral activation and inhibition sensitivities among college students at risk for bipolar spectrum symptomatology. *Journal of Psychopathology and Behavioral Assessment, 21*, 275-292.

Meyer, B., Johnson, S.L., & Winters, R. (2001). Responsiveness to threat and incentive in bipolar disorder: relations of the BIS/BAS scales with symptoms. *Journal of Psychopathology and Behavioral Assessment, 23*, 133-143.

Meyer, T.D. (2002). The Hypomanic Personality Scale, the Big Five, and their relationship to depression and mania. *Personality and Individual Differences, 32*, 649-660.

Meyer, T.D., & Baur, M. (2009) Positive and negative affect in individuals high and low at risk for bipolar disorders. *Journal of Individual Differences*, 30, 169-175

Meyer, T.D. & Hautzinger, M. (2001). Allgemeine Depressions-Skala (ADS) – Normierung an Minderjährigen und Erweiterung zur Erfassung manischer Symptome (ADMS). *Diagnostica, 47*, 208-215.

Meyer, T.D., & Hautzinger, M. (2003). The structure of affective symptoms in a sample of young adults. *Comprehensive Psychiatry, 44*, 110-116.

Meyer, T.D., & Hofmann, B.U. (2005). Assessing the dysregulation of the Behavioral Activation System: The Hypomanic Personality Scale and the BIS/BAS Scales. *Journal of Personality Assessment*, 85, 318-324.

Meyer, T.D., & Krumm-Merabet, C. (2003). Academic performance and expectations for the future in relation to a vulnerability marker for bipolar disorders: the hypomanic temperament. *Personality and Individual Differences, 35*, 785-796.

Meyer, T.D., & Maier, S. (2006). Social rhythm irregularities in individuals putatively at risk for affective disorder. *Psychiatry Research, 141*, 103-114.

Peterson, C., Semmel, A., Baeyer, C.v., Abramson, L.Y., Metalsky, G.I., & Seligman, M.E.P. (1982). The Attributional Style Questionnaire. *Cognitive Therapy and Research*, 6, 287-300.

Radloff, L.S. (1977). The CES-D: A Self-Report Symptom Scale to detect Depression in the General Population. *Applied Psychological Measurement*, 3, 385-401.

Raven, J.C., Court, J., & Raven, J.Jr. (1980). *APM. Raven-Matrizen-Test. Advanced Progressive Matrices*. Weinheim: Beltz.

Reilly-Harrington, N.A., Alloy, L.B., Fresco, M.A., & Whitehouse, W.G. (1999). Cognitive styles and life events interact to predict bipolar and unipolar symptomatology. *Journal of Abnormal Psychology, 108,* 567-578.

Ross, R.R., Millis, S.R., Bonebright, T.L., & Bailley, S.E. (2002). Confirmatory factor analysis of the Behavioural Inhibition and Activation Scales. *Personality and Individual Differences, 33,* 861-865.

Stern, G.S., & Berrenberg, J.L. (1979). Skill-set, success outcome, and mania as determinants of the illusion of control. *Journal of Research in Personality, 13,* 206-220.

Thompson, M., & Bentall, R.P. (1990). Hypomanic personality and attributional style. *Personality and Indiviudal Differences*, 11(8), 867-868.

Watson, D., Clark, A.L., & Carey, G. (1988). Positive and negative affectivity and their relation to anxiety and depressive disorders. *Journal of Abnormal Psychology, 97,* 346-353.

Wittchen, H.U., Zaudig, M., & Fydrich, T. (1997). SKID *Strukturiertes Klinisches Interview für DSM-IV Achse I und II. Handanweisung.* Göttingen: Hogrefe.

Table 1: Regression models predicting attributional styles after success in two unrelated tests.

	B	SE B	β	
Internal attributions				
Ability-based test	Modell 3: F (6, 114) = 2.52*			
Current symptoms of depression	0.018	(0.019)	0.093	
Affective Disorder	0.105	(0.415)	0.024	
BIS	-0.056	(0.040)	-0.136	
BAS	0.113	(0.030)	0.387	***
BAS-Dysregulation	-0.001	(0.023)	- 0.136	
HPS	-0.037	(0.018)	-0.223	*
Chance-based test	All Models: F < 0.77			
Stable attributions				
Ability-based test	Model 3: F (6, 114) = 2.39*			
Current symptoms of depression	0.022	(0.014)	0.153	
Affective Disorder	-0.225	(0.310)	-0.069	
BIS	-0.052	(0.030)	-0.170	(*)
BAS	0.068	(0.022)	0.314	***
BAS-Dysregulation	- 0.018	(0.017)	-0.102	
HPS	0.023	(0.013)	-0.189	(*)
Chance-based test	Model 2: F (5, 114) = 2.28(*)			
Current symptoms of depression	-0.021	(0.020)	-0.097	
Affective Disorder	0.153	(0.465)	0.031	
BIS	0.134	(0.044)	0.294	**
BAS	0.029	(0.030)	.089	
BAS-Dysregulation	- 0.006	(0.026)	-.020	

Table 1 continued:

Global attributions				
Ability-based test	Model 1: F (2, 114) = 5.81**			
Current symptoms of depression	-0.056	(0.017)	-0.316	***
Affective Disorder	0.332	(0.383)	0.080	
Chance-based test	Model 3: F (6, 114) = 2.46*			
Current symptoms of depression	-0.069	(0.025)	-0.281	***
Affective Disorder	0.103	(0.537)	0.018	
BIS	0.014	(0.052)	0.027	
BAS	-0.065	(0.039)	-0.171	(*)
BAS-Dysregulation	0.055	(0.030)	0.176	
HPS	0.062	(0.023)	0.288	***
Personal relevance attributions				
Ability-based test	Model 2: F (5, 114) = 3.52**			
Current symptoms of depression	-0.032	(0.020)	-0.150	
Affective Disorder	0.441	(0.461)	-0.089	
BIS	0.079	(0.044)	0.172	(*)
BAS	0.097	(0.030)	0.293	***
BAS-Dysregulation	-0.025	(0.026)	-0.082	
Chance-based test	All Models 3: F < 1.79			

Notes: Current symptoms of depression = CES-D scores; BIS = Behavioral Inhibition Scale, BAS = Behavioral Activation Scale; HPS = Hypomanic Personality Scale

(*) $p \leq .10$ * $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$

Table 2: Regression models predicting Cognitive Style after success in two unrelated tests.

	B	SE B	β	
Cognitive Style				
Ability-based test	Modell 2: F (5, 114) = 4.80***			
Current symptoms of depression	-0.040	(0.046)	-.083	
Affective Disorder	0.746	(0.991)	-.068	
BIS	-0.051	(0.096)	-.050	
BAS	0.332	(0.072)	.454	***
BAS Dysregulation	-0.071	(0.042)	-.170	(*)
Chance-based test	Model 3: F (6, 114) = 4.53***			
Current symptoms of depression	-0.135	(0.063)	-.218	*
Affective Disorder	0.206	(1.359)	.014	
BIS	0.233	(0.096)	.176	(*)
BAS	-0.012	(0.098)	-.013	
BAS Dysregulation	0.077	(0.077)	.098	
HPS	0.142	(0.058)	.262	*

Notes: Current symptoms of depression = CES-D scores; BIS = Behavioral Inhibition Scale, BAS = Behavioral Activation Scale

(*) $p \leq .10$ * $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$

Footnotes

[1] The editor recommended, however, that it would also be beneficial to briefly summarize the results of the BAS subscales (drive, reward responsiveness and fun-seeking) in addition to the BAS composite score. We present these as footnotes, because the study was originally based on a power analysis which would not allow for inclusion of further variables in the analyses.

[2] Using the BAS subscales, only Model 3 and the associated ΔR^2 were significant for the ability-based test ($R = .369$, $R^2 = .136$, $\Delta R^2 = .036$, $F_{(1,106)} = 4.46$, $p < .05$) with BAS Drive ($\beta = .30$) and HPS ($\beta = -.24$) being significant predictors. For the dice test, no overall model proved significant, but adding scores on HPS as last block led to significance (ΔR^2 , $R = .218$, $R^2 = .048$, $\Delta R^2 = .037$, $F_{(1,106)} = 4.14$, $p < .05$) with the HPS scores as the only significant predictor ($\beta = .24$).

[3] With regard to the dice test, only Model 2 was significant and provided a significant ΔR^2 using the BAS subscales ($R = .353$, $R^2 = .125$, $\Delta R^2 = .123$, $F_{(5,107)} = 3.00$, $p < .01$) with BIS ($\beta = .29$) and BAS Drive ($\beta = .22$) being significant predictors of stable attributions.

Footnotes (continued)

[4] With regard to the ability test, the results were identical when using the BAS composite scale, i.e. the only significant predictor was current depression (β = -.32). For the chance-based test, Models 2 and 3 proved significant, and adding the BIS-BAS subscales significantly increased predictability (R =.387, R^2 =.150, ΔR^2 =.123, $F_{(5,107)} = 3.11$, $p < .01$). Adding scores on HPS led to a non-significant increase in ΔR^2 ($F_{(1, 106)} = 3.48$, $p < .10$, R =.421, R^2 =.172, ΔR^2 =.027). Current symptoms of depression (β = -.27), BAS reward responsiveness (β = -.31) and BAS dysregulation (β = .21) were significant predictors, whereas HPS scores showed a trend (β = .20).

[5] Using the BAS subscales, only adding the BIS-BAS dimensions yielded a significant model and a significant increase in ΔR^2 (R =.385, R^2 =.147, ΔR^2 =.126, $F_{(5,114)} = 3.16$, $p <$ .01), with BAS fun seeking (β = .22) as the only significant predictor for the attribution with respect to the ability test, and current depression (β = -.14) and BIS (β = .18) showing trends. For the dice test, only a trend emerged for increasing ΔR^2 when scores on HPS were added (R =.313, R^2 =.098, ΔR^2 =.023, $F_{(1,106)} = 2.71$, $p < .10$). Only HPS scores showed a trend as predictor variable (β = .19).

[6] For the ability-based test, ΔR^2 significantly increased after adding the BIS-BAS subscales (R =.434, R^2 =.188, ΔR^2 =.156, $F_{(5,107)} = 4.12$, $p < .01$), and HPS scores (R =.469, R^2 =.220, ΔR^2 =.032, $F_{(1,106)} = 4.32$, $p < .05$). Significant predictors were BAS drive (β = .25), BAS fun seeking (β = .32) and HPS scores (β = -.22). For the chance-based test only adding HPS scores significantly increased ΔR^2 (R =.340, R^2 =.116, ΔR^2 =.040, $F_{(1,106)} = 4.85$, $p < .05$). Significant predictors were current depression (β = -.21) and HPS scores (β = .25). A trend occurred for BIS (β = .19).